Orbit Photo Contest

Attention photographers! Bently Nevada is looking for photographs of plant machinery or of plant sites to include in the Orbit! Prizes will be awarded (approximate value of $100 each).

There are several requirements for submitted photos:

- Entries must be submitted either as 35mm slides (transparencies) or 8" × 10" (or approximate equivalent) glossy prints.
- A *removable* identification label with your name, office and photo information (type of machine and/or type of plant and location) should be affixed to the back of the photo or slide. **Please don't write on the photo.**
- All entries must be received by 1 July 1992. Send your photos to Mary Sue Matthews, Bently Nevada Corporation, P.O. Box 157, Minden, Nevada 89423.
- **DO NOT SEND YOUR ORIGINAL!**
- By entering this contest, you are granting Bently Nevada Corporation the right to publish the photos in any corporate literature or advertising. You must obtain a written release from any recognizable people in the photo which states that they authorize this use of their photo.

All photos must be authorized for publication by Plant Management.

Future Contest

For many years, Bently Nevada has printed informative case histories in the Orbit. We would like to hear about machine saves at your plant. Articles should document how Bently Nevada Systems were used to successfully diagnose and solve machinery problems. Prizes will be awarded (approximate value of $100 each). See the September 1992 Orbit for more details. All entries must be received by 30 November 1992.

Balancing Puzzle Solution

(see puzzle on page 7)

Let each bearing have a direct stiffness of K and each rotor element a mass M. The translational balance resonance equation with an unbalance mass $\frac{M_U}{2}$ at each rotor mass at 0° at radius r is, for both inboard and outboard ends

$$\text{Motion}_{\text{Translational}} = \frac{\text{Force}}{\text{Restraint}} = \frac{\left(\frac{M_U}{2}+\frac{M_U}{2}\right)(r)\,(\Omega^2)}{2K + j\Omega\,(1-\lambda)\,D_T - 2Mr^2}$$

The two springs are in parallel action, and the two masses move together.

For the pivotal action, apply an unbalance of $\frac{M_U}{2}$ at the inboard end at radius r at 0°, and an imbalance of $\frac{M_U}{2}$ at the outboard end at radius r at 180°. The pivotal motion equation is, for the inboard end

$$\text{Motion}_{\text{Pivotal}} = \frac{\left(\frac{M_U}{2}+\frac{M_U}{2}\right)\Omega^2}{K + \Omega\,(1-\lambda)\,D_P - r^2M}$$

and the same with opposite polarity for the outboard end.

where M_U is unbalance mass

Ω is rotative speed

λ is the ratio of average fluid circumferential speed

$+j$ is $\sqrt{-1}$

D_T is translational mode damping

D_P is pivotal mode damping

The translational balance resonance frequency is

$$\omega_{\text{Translational}} = \sqrt{\frac{2K}{2M}} = \sqrt{\frac{K}{M}}$$

The pivotal balance resonance is $\sqrt{\frac{K}{M}}$;

the same, exactly, (with matched quadrature stiffness and ignored gyroscopics).

Because the DENOMINATORS are the same, this very special rotor system self balances itself in BOTH MODES in exactly the same speed range.

The case given was neither for the translational or pivotal equations as given, but for a mass unbalance M_U at one end. However, by adding the two sets of unbalances, you have at the inboard end $\frac{M_U}{2} + \frac{M_U}{2} = M_U$ and at the outboard end $\frac{M_U}{2} - \frac{M_U}{2} = 0$, the stated condition.

The total action is therefore at the unbalanced inboard end:

$$\text{Motion} = \frac{Mr\Omega^2}{K + j\,(1-\lambda)\,D - \Omega^2M}$$

and at the outboard end: ZERO motion. See Figure 1.

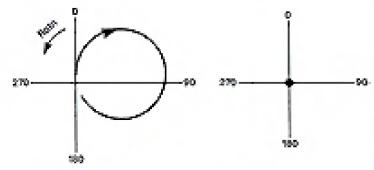

Figure 1
Solution to balancing puzzle

At Your Service

Steve Sabin has been appointed Sales Engineer for Bently Nevada's new Calgary, Alberta, Canada office. He has a BSEE Degree from Oregon State University and will offer Sales support to Southern Alberta, Saskatchewan and Manitoba. Product Service, Machinery Diagnostic Services and Technical Training will continue to be available through our Nisku office.

Ronnie Gaussiran has been promoted to Sales Representative in our office in Baton Rouge, Louisiana. He has a Bachelor of Science Degree in Engineering & Technology and two Associate in Science Degrees in Instrumentation Technology and Electronic Technology from McNeese State University.

Xiuzhu Huang, Sr. Engineer of the People's Republic of China's Thermal Power Research Institute (TPRI), is currently studying at Bently Rotor Dynamics Research Corporation (BRDRC). TPRI is a division of the Chinese Ministry of Energy. She is a specialist in Mechanical Engineering and will study machinery diagnostics in Minden for six months.

Inam Ul Haq, who recently received a Masters Degree in Mechanical Engineering from Carleton University in Ottawa, Canada, is undergoing training at BRDRC in rotating machinery diagnostics and vibration monitoring. Mr. Haq has ten years field experience working in the chemical and petrochemical industries in Asia and the Middle East.

BRDRC provides an opportunity for scientists throughout the world to receive training in machinery diagnostics.

1992 Worldwide Seminar Schedule

Date	Course Description	Location
	United States	
July 20-24	3300 System Installation & Maintenance	Minden, Nevada
August 17-21	Data Acquisition	Minden, Nevada
August 24-28	Machinery Diagnostics	Minden, Nevada
October 12-16	Machinery Diagnostics	Minden, Nevada
October 19-22	Machinery Diagnostics Workshop (ADRE® 3/DVF3)	Minden, Nevada
November 30 - December 4	Advanced Machinery Diagnostics & Dynamics	Minden, Nevada
	Canada	
October 13-15	Machinery Monitoring	Saint John
November 17-19	Machinery Monitoring	Regina
December 1-4	Machinery Diagnostics	Vancouver
	Europe	
September 15-17	Machinery Monitoring	Warrington, England
September 22-24	Rotating Machinery Vibration and Predictive Maintenance	Warrington, England
October 6-9	Machinery Monitoring	Warrington, England
October 20-22	Balancing and Alignment	Warrington, England
December 1-3	Machinery Monitoring	Warrington, England
October 13-15	Machinery Monitoring	Versailles, France
November 17-20	Data Acquisition	Lyon, France
December 7-11	Machinery Diagnostics	Marseille, France
November 3	Introduction to Vibration and Predictive Maintenance	Zoetermeer, The Netherlands
November 4-6	Machinery Monitoring	Zoetermeer, The Netherlands
November 9-13	Data Acquisition	Zoetermeer, The Netherlands
November 16-20	Machinery Diagnostics	Zoetermeer, The Netherlands
June 10-12	Machinery Monitoring	Oslo, Norway
September 22	Introduction to Vibration Measurement and Predictive Maintenance	Stavanger, Norway
November 9-13	Machinery Diagnostics	Bergen, Norway
	Southeast Asia	
July 20-22	Data Acquisition	Penang, Malaysia
July 23-31	Machinery Diagnostics and Diagnostics Workshop	Penang, Malaysia
September 14-16	Machinery Monitoring	Pattaya, Thailand
September 17-25	Machinery Diagnostics and Diagnostics Workshop	Pattaya, Thailand
November 9-13	Balancing and Alignment	Singapore

Seminars are conducted in the language customarily spoken in the country hosting the seminar unless otherwise indicated.
The seminars in Singapore are conducted in English. • In the United States, call toll-free (800) 227-5514 ext. 9682.